

**Alaska Region
Plan for
Air Resource Management
2009-2013**



January, 2009

Preparation and Review: This document was prepared by Karen Dillman, Tongass National Forest Ecologist, and builds on multiple efforts in Forest and Alaska Region air program management over the last two decades. Assistance was provided by Bill MacFarlane, Chugach National Forest Hydrologist, and Betty Channon, Chugach National Forest Ecologist. David Mott, Alaska Region Watershed and Air Program Manager provided oversight and guidance. Appreciation is given to Rick Graw, Linda Geiser, and Jim Russell, Region 6 Air Resource Specialists for their continued interest and support to the air program in Region 10. The plan was presented in a formal meeting of the Regional Leadership Team in December, 2008, and submitted for regional review shortly thereafter.

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Cover photos by Karen L. Dillman Tongass National Forest, and Bill MacFarlane, Chugach National Forest

Executive Summary

Forest Service land managers are directed to protect, manage and monitor air resources on federal lands. Before 1989, air monitoring conducted in the Alaska Region was by the Alaska Department of Environmental Conservation (ADEC) and Environmental Protection Agency (EPA). Six pollutants known to cause harm to human health are monitored in limited urban and industrial zones (ozone, carbon monoxide, particulates, sulfur dioxide, lead and nitrogen oxides). The U.S. Forest Service began monitoring air quality with lichens on the Tongass in 1989 and on the Chugach in 1994. Lichens are sensitive bioindicators and serve as a dynamically representative sample of the environmental conditions in which they are growing. Air quality in the Alaska Region is relatively clean compared to other FS Regions in the United States due to high precipitation, oceanic winds, low population, and, in most cases, large distances from major pollution sources. However, pollution that does affect air quality on National Forest Lands in Alaska comes from sources such as forest fires, prescribed burning, dust from glaciers and unpaved roads, volcanic eruptions, mining operations, fuel combustion from marine vessels (especially sight-seeing ships), other vehicles, wood stoves, and some industry. Additional air quality issues exist in areas on both Forests due to close proximity to industrial zones such as Anchorage, Valdez, and Juneau. Trans-Pacific PAN (peroxyacetyl nitrate), persistent semi-volatile organic pollutants (or POPs such as PCBs and DDT), and greenhouse gases are a growing concern. Of all air quality related issues in Alaska, climate change and the associated stresses pose the greatest threat to forest ecosystem stability and biodiversity.

This plan covers seven program elements: 1) inventory and monitoring, 2) coordination with other agencies, FS Regions and outside groups, 3) education and awareness, 4) research and technology development, transfer and needs, 5) NEPA and Forest Plan direction and implementation, 6) program administration and 7) climate change. Each element contains a scope, current situation, desired state and strategies to help achieve the desired state within a particular element. The use of biomonitoring with lichens is one technology that is used successfully in the Region. The development of a biomonitoring plan in relation to wilderness management goals and Forest Plan direction will involve a majority of the Air Resource Management (ARM) workload in the Region. Coordination and encouraging research on the impacts of pollutants and climate change on natural resources will also be an area of emphasis.

I. Introduction:

Before 1989, the Alaska Department of Environmental Conservation (ADEC) and the Environmental Protection Agency (EPA) monitored air quality in limited urban and industrial zones in Alaska. Since 1989, land managers from the Forest Service Alaska Region have monitored National Forest air quality with lichens and are now better informed about regional air quality issues, especially in designated wilderness areas (Geiser et al 1994, Derr 1997, Dillman et al 2007). Alaska Region air quality is clean compared to other Forest Service Regions in the United States due to high precipitation, cool temperatures, oceanic winds, low population, and, in most cases, great distances from major pollution sources. In Alaska, pollutants come from forest fires in interior Alaska and Canada; glacial, volcanic, and road dust; mining, fuel combustion from marine vessels (especially sight-seeing ships), other vehicles, wood stoves, and light industry. Additional air quality concerns exist in some areas because of close proximity to major industrial areas such as Anchorage, Valdez and Juneau. Trans-Pacific PAN (peroxyacetyl nitrate), persistent semi-volatile organic pollutants, and greenhouse gases are a growing concern. Of all air quality related issues in Alaska, climate change poses the greatest threat to overall forest ecosystem stability and biodiversity.

The objectives of the Alaska Region Plan for Air Resource Management (ARM) are to: 1) provide a common set of strategies for air resource issues that are pertinent to the National Forests in Alaska, and 2) provide regional and forest-level land managers guidance and effective coordination in inventorying, monitoring and protection of the air resource in the implementation of ecosystem management. The focus of this plan encompasses present and expected Region 10 ARM program work through 2013. This plan will be utilized by the Regional Office, Chugach and Tongass Supervisors office in developing an ARM program, including the development of out-year budgets and yearly Integrated Program of Work and Work Chunk proposals.

II. Vision Statement

The mission of ARM in Region 10 is to understand, quantify, and protect regional air quality conditions and ecosystems, with particular emphasis on wilderness values. Our goal is to implement a plan that helps us integrate effectively with other regulatory, research and land management agencies and to be responsive to public interests concerning air pollution and climate change effects on the National Forests of Alaska.

III. Direction and Responsibilities of the Forest Service for Air Resource Management

Direction for Forest Service land managers to protect, manage and monitor the air resources on federal lands is provided in the following statutes:

1. The Clean Air Act (CAA) of 1963 and amended in 1970, 1977, and 1990: The CAA is the basic framework for controlling air pollutants in the United States, designed to “protect and enhance” air quality while ensuring protection of public health and welfare. The act established National Ambient Air Quality Standards (NAAQS) that must be met by state and federal agencies and private industry. The CAA requires the Forest Service to protect the natural resources we manage from the adverse effects of anthropogenic air pollution. The CAA specifically mentions the need to protect visibility in Class I wilderness areas of the NFS (those USFS wilderness areas in existence as of August 7, 1977 larger than 5,000 acres). There are no CAA Class I wilderness areas in the Alaska Region; all USFS lands, including wilderness, are Class II. The CAA also requires the Forest Service to ensure that emissions from NFS do not violate Federal or State health standards. The EPA has established NAAQS for specific pollutants (carbon monoxide, nitrogen oxide, ozone, sulfur dioxide, lead and particulate matter PM₁₀ and PM_{2.5}) that must be met by state and federal agencies and private industry.

2. The Wilderness Act (WA) of 1964: The WA contains language directing wilderness areas to be administered “for the use of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” The National Forest System Wilderness Implementing Regulations state that “Wilderness resources shall be managed to promote, perpetuate and where necessary restore the wilderness character of the land.”

3. The 10-Year Wilderness Stewardship Challenge (10YWSC): The 10YWSC renews the commitment to wilderness by pledging to bring all Forest Service wildernesses up to a minimum level of stewardship within 10-years for the 50th Anniversary of the Wilderness Act in 2014. The stated air objective is to “develop a wilderness air quality value plan identifying air quality values, sensitive receptors and indicators.” This is accomplished by monitoring of wilderness air quality values and establishing a baseline for the wilderness. Each wilderness is also committed to developing an Information Needs Assessment that identifies potential threats to wilderness character, such as air pollution.

4. The Federal Land Management Policy Act of 1976 (43 U.S.C. 1701 et seq.) (FLMPA): This act declares as a policy of the United States that “ the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource and archeological values; that where appropriate will preserve and protect certain public lands in their natural condition.

5. The Forest and Rangeland Renewable Resource Planning Act of 1974 (FRRRP) as amended by the National Forest Management Act (NFMA) (16 U.S.C. 1602): This Act directs the Secretary of Agriculture to protect and, where appropriate, improve the quality of soil, water and air resources.

6. Forest Service Manual 2500 (FSM): Air is identified as a basic National Forest System resource to be protected. In the management of this resource the Region shall cooperate with other Federal, state and local regulatory agencies as well as the public and private land managers to: 1) minimize the impact of the Region's management activities on air quality and comply with requirements of federal, state and local regulatory authorities; 2) affirmatively protect Air Quality Related Values (AQRV) within the Region's Class I wilderness areas (2580.5-Exhibit 01); 3) Protect Resource Values Affected by Air Pollution (RVAAP) on all National Forest System lands; and 4) maintain or improve air quality within Class I airsheds (2580.5-Exhibit 02). FSM 2580.43 states that among other direction, Regional Foresters shall monitor the effects of air pollution and atmospheric deposition on forest resources and air quality related values.

7. Regional Haze Rule 1999: The Regional Haze Rule of 1999 requires states and interested tribes to address sources of pollution contributing to regional haze in the 156 mandatory Class I areas. To do this, states are in the process of developing State Implementation Plans (SIPs) to demonstrate to the public, the Federal Land Managers (FLMs) and EPA how they plan to address regional haze to reach the goal of natural background conditions by the year 2064. The Forest Service, as the FLM of 88 mandatory Class I areas, has been working closely with the states, interested tribes, EPA, and the regional planning organizations in the development of the technical products and policy documents that are being used by each state as they develop their plans. The state SIPs were due to EPA by December 17, 2007. By law, the FLMs of the mandatory Class I areas have a formal consultation with each state 60-days before the draft plans go to public hearing. As stewards of the resource targeted for protection, the Forest Service has a special duty to ensure the Class I wildernesses under our responsibility are managed for the use and enjoyment of current and future generations.

The Alaska Regional Director of Wildlife, Fisheries, Ecology, and Watershed submitted a letter concerning the Regional Haze Rule to Alaska Department of Environmental Conservation in November 2007. Due to the lack of Class I wilderness areas in Region 10, this element does not include a USFS review of state-processed permit applications for new point sources of air pollution (Prevention of Significant Deterioration permits or PSD's) or the review of State Implementation Plans (SIP's) and operating permits that are required for Class I areas. However, the Alaska Region is interested in maintaining a working relationship with the state in the SIP preparation process. The Region's main focus in this arena will be in our involvement with the Alaska Wildland Fire Coordinating Group. Reductions will have immediate benefits to Region 10 lands, especially on the Chugach, as the sources are nearer to USFS public lands than the Class I wilderness areas in the State.

8. General Conformity Rule: The General Conformity Rule ensures that federally funded or supported actions taken by federal agencies and departments, including the Forest Service, meet national standards for air quality in federal non-attainment and maintenance areas. Under the Federal Clean Air Act, any area that violates national ambient air quality standards for any of the six criteria pollutants is designated as a "non-attainment area." These pollutants are *sulfur dioxide, fine particulate matter, carbon monoxide, ozone, nitrogen oxides, and lead*. Maintenance areas are any non-attainment areas that have been re-designated to attainment status and may be more sensitive to maintaining the designation. Juneau and Fairbanks are considered non-attainment areas for *fine particulates* between 2000 and 2006 (EPA 2008).

Activities that emit significant levels of criteria pollutants in a non-attainment or maintenance area are subject to the conformity rule. This rule requires the Forest Service or any federal agency to demonstrate that their action will not impede the State Implementation Plans to attain or maintain the ambient air quality standard. A few examples of activities on National Forests

that may require a review for conformity include: 1) fuel treatments including prescribed fire and harvest activities, 2) road, trail, or building construction, and 3) land use and special use permit decisions such as ski or winter sports areas, mining, oil and gas development and landfills.

9. Forest Plan Direction. The land and resource management plans of both the Chugach and the Tongass NFs have goals and objectives for maintaining the current air quality, managing AQRVs, and related information and research needs. Both plans call for compliance with state standards for visibility and particulates. Each wilderness on the Tongass NF is using lichens as an AQRV sensitive receptor. The Chugach has an extra directive to coordinate with the State of Alaska to manage prescribed fire to minimize smoke on the Kenai Peninsula.

IV. Current Region 10 Air Program Activities and Accomplishments

- **Lichens as Biomonitors** - Baseline monitoring of air quality with lichens began on the Tongass NF in 1989 and the Chugach NF in 1994. Thresholds for 27 contaminants in target lichens have been established for the Tongass NF. Concentrations above these thresholds can be considered elevated above background due to some external source (anthropogenic or natural). Of the 127 permanent monitoring sites, 58 contained at least one lichen species that was at or above threshold for one or more contaminants (Dillman et al 2007). Twenty of the 58 sites are in wilderness areas. Areas outside wilderness with several to many contaminants above threshold include the Sitka area near the closed pulp mill and downtown area, Juneau's Mt Roberts, and the vicinity of the Greens Creek mine on Admiralty Island. Baseline levels for elements in lichens were generated from 34 sites on the Chugach NF (Derr 1997 draft report). The report has not been finalized. Although baseline and thresholds exist for nitrogen and sulfur and other pollutants of interest, trend data do not exist for the Region. Trend data need to be gathered for many years to determine if these elements are increasing across the region due to on or off-forest emissions. Most biomonitoring locations on the Tongass NF and Chugach NFs have only been visited once (for establishing baseline). Contaminant data are found at <http://gis.nacse.org/lichenair/index.php>. Region 10 ARM produced a brochure titled *Lichens of the National Forests in Alaska* that contains information on common lichens and describes lichens as air quality indicators in the Region <http://gis.nacse.org/lichenair/index.php?page=reports#R10>
- **IMPROVE Particulate Monitor** - Region 10 has one IMPROVE Protocol air monitoring station located on the Tongass NF in Petersburg since 2004. IMPROVE (Interagency Monitoring of Protected Visual Environments) is part of a visibility monitoring network across the United States with many federal partners. The monitoring station includes four particulate monitors that sample the chemical spectrum with emphasis on tracers for identifying pollution sources and on *nitrate, sulfate, carbon, soils* and *organics*, the primary compounds responsible for visibility impairment. The Region 10 site does not have a nephelometer that relates closely to visual quality nor meteorological equipment. This station provides regional particulate information from on and off Forest activities, as well as trans-Pacific pollution trends. Data are managed by Colorado State University at <http://vista.cira.colostate.edu/improve/Data/data.htm>
- **WACAP (Western Airborne Contaminant Assessment Program)** - WACAP was initiated in 2002 by the National Park Service to determine the risk to ecosystems and food webs in western national parks and wilderness areas from the global transport of airborne contaminants (NPS 2008). The Tongass NF participated as a secondary park for this assessment. Nearby Glacier Bay and Wrangell St. Elias National Parks also participated as secondary parks. The analysis of the vegetation (lichens and spruce needles) in the Stikine-LeConte Wilderness concluded that the samples were at or below the median for semi-

volatile organic compounds (SOCs) such as CUPs (Current Use Pesticides), PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons), and at or above the median for HUPs (Historic Use Pesticides); this pattern was also observed at other high precipitation sites along coastal Alaska (i.e. Katmai, Wrangell St. Elias and Glacier Bay National Parks) (NPS 2008). Therefore, it can be assumed that similar levels of these pollutants may be found in other areas of the Chugach and Tongass NFs. The full report is found at http://www.nature.nps.gov/air/studies/air_toxics/wacap.cfm

- **Smoke Management** - The Alaska Wildland Fire Coordinating Group (AWFCG) has an annual operating plan that the State follows and is updated each year. This group is made up of representatives from all Federal, State, and Tribal agencies in Alaska. When smoke levels are high from wildland fires, the AWFCG puts out news releases to make the public aware and what they can do to minimize particulate exposure.
- **Cruise Ship Emissions** - Tongass Wilderness Rangers and the Alaska Department of Environmental Conservation have partnered to share information on cruise ship visible emissions in Tracy Arm. Forest Service Rangers are certified in EPA Method 9 and conduct opacity readings, which DEC may use for enforcement.
http://www.dec.state.ak.us/water/cruise_ships/cruise_air.htm
- **Winter motorized use emissions-** In 2007, the Chugach NF measured carbon monoxide and fine particulate concentrations in an area on the Forest that is popular for snow machine use. This study collected data on busy weekend days throughout the winter to determine whether the potential that motorized uses are causing violations of the State air quality standards. A pilot protocol was developed for this study to address the Forest Service Chief's response to a Forest Plan appeal, and a new monitoring question was developed in the Forest Plan to address this issue.
- **Modeling of air quality in relation to diesel emissions** – In 2008, a partnership was developed among Region 10 and Region 6 ARM, Tongass National Forest, SE Alaska National Park Service (NPS), Forestry Inventory and Analysis (FIA) and Pacific Northwest (PNW) and Pacific Southwest (PSW) Research Stations in passive air sampler deployment and lichen inventory and contaminant analysis. The work is to assess and model air borne contaminant presence and relative concentrations near sensitive locations with cruise ship traffic and other potential emission sources. Locations for this work include Tracy Arm/Fords Terror Wilderness, Klondike Goldrush Historical Park, Glacier Bay National Park and Sitka Historical Park.

V. Known and potential sources of air pollution in Region 10 from on and off-Forest

Natural impacts

- **Wildland fire:** smoke particulates from the Kenai Peninsula, interior Alaska and eastern Asia
- **Volcanic ash:** particulates and gases from eruptions in Asia, the Aleutian Islands and Alaska Peninsula
- **Loess from glacial and large riparian areas:** particulates from winds on glacial rivers such as the Copper, Taku, and Stikine, and from the Yukon and Kluane ice fields

Human caused impacts

- **Prescribed fire and open burning:** smoke particulates from the Kenai and other areas, open burning of different sizes and intensities in rural and non-rural areas
- **Unpaved roads:** emit dusts containing heavy metal particulates from engines as well as local soils and rock dusts becoming airborne
- **Recreation sites:** unpaved campsites and cooking fires

- **Mining activities and exploration:** Greens Creek, Kensington, and other smaller mine operations that emit particulates such as heavy metals and fossil fuel emissions
- **Marine vessel emissions:** fossil fuel emissions from luxury cruise ships and other large vessels using the waterways and docks throughout the region
- **Other fossil fuel emissions:** all vehicle types including cars, trucks, ATV's and snowmobiles, recreation boats, fixed wing aircraft, helicopters and commercial jets
- **Power plants:** emissions around communities that use diesel generated power
- **Oil and gas exploration and production:** emissions from Cook Inlet and Kenai Peninsula operations. Each oil and gas drilling operation discharge small amounts of waste (ozone, oxides of nitrogen, and sulfur compounds) into the air
- **Urban sprawl and industrial emissions:** associated fossil fuel emissions around expanding communities such as Anchorage, Valdez, Girdwood, Juneau and Ketchikan
- **Trans-Pacific pollutants:** of all types including nitrogen from Asian sources
- **Persistent organic pollutants (POPs) and semi-volatile organic pollutants (SOCs)** emitted around the world

VI. Program Elements and Strategies:

The following seven program elements provide a description of the scope, current situation, desired state and strategies to achieve the desired state. These elements will be used to guide effective integration of air resource considerations in the implementation of ecosystem management.

1. Inventory and Monitoring
2. Coordination with other agencies, regions and outside groups
3. Education and Awareness
4. Research and Technology Development, Transfer and Needs
5. NEPA and Forest Plan Direction and Implementation
6. Program Administration
7. Climate Change

Program Element 1: Inventory and Monitoring

Scope:

This element includes inventory and monitoring actions taken to help determine the condition of the air and other resources that may be impacted by air pollution from on and off-forest emissions. Actions include inventorying, monitoring, modeling, and consulting on the biological effects of air pollution. Air resource specialists consider lichens as one of the primary sensitive receptors to be first affected by certain air pollutants. This element also includes predicting the effects of air pollution and managing data and information from inventories and monitoring sites.

Current Situation:

Forests in the Alaska Region began the inventory of lichen communities and monitoring of up to 27 contaminants in lichens in the late 1980s (Tongass NF) and early 1990s (Chugach NF). Provisional thresholds for 27 contaminants in lichens are established on the Tongass NF (Dillman et al 2007). Final biomonitoring reports have been prepared for the Tongass NF: one general technical report (Geiser et al 1994) and one final internal report (Dillman et al 2007). A draft report was prepared for the Chugach NF (Derr 1997).

The Petersburg IMPROVE site is an air monitoring station that collects data on airborne nitrates, sulfates, carbon, soils and organics for Region 10. It was installed in 2004, and will run through 2009. The data analysis and interpretation are generally two-years behind the present. There is no visibility monitoring program in the Region. Passive deposition monitors have been deployed in Tracy Arm wilderness in 2008, to gather concentrations of ammonium, nitrates, sulfates and hydrogen ions in bulk precipitation and canopy throughfall in relation to cruise ship emissions as part of a regional modeling effort with NPS and Forest Service Region 6 (see above under Modeling of Air Quality in Current Projects). Carbon monoxide and fine particulate concentrations were measured in an area on the Chugach that is popular for snow machine use.

Desired Future State:

ARM is an integral part of ecosystem management. The State of Alaska understands and supports the protection of sensitive ecosystems on National Forest land in Alaska. Coordinated efforts with the state and other federal agencies is underway to provide state-of-the-art technology and information in the decision making process for actions taken to determine air pollution exposure and extent, and to reduce air pollution impacts. An efficient and sensible monitoring program is implemented to gather legally defensible and credible data on air quality and sensitive receptors to show baseline, thresholds and trends over the national forests in the Alaska Region.

Strategies:

1. Develop a regional lichen biomonitoring plan consistent with ARM, National Forest Inventory and Monitoring objectives, and Forest Plan goals and objectives for air. Coordinate efforts with NPS, FIA and Region 6 for the efficient use of resources and technical expertise. Ideally, biomonitoring plots should be revisited every ten years over a two-year period. A subset of the plots should be visited every five years to collect lichen tissue for nitrogen analysis to help develop trend information for trans-Pacific pollutant detection and effects.
2. Finalize Chugach NF lichen biomonitoring report, process voucher specimens, and make the checklist of lichens available to the scientific community and the public.
3. Consider the deployment of Ogawa passive samplers in wilderness areas and other sensitive areas where cruise ships visit in coordination with the NPS program to estimate ambient concentrations of sulfur dioxide, nitrogen oxide, nitrogen monoxide, ammonium, ammonium nitrates, and ammonium oxides in conjunction with lichen biomonitoring. This deployment is in conjunction with the presently established throughfall sampler network of sites that collect contaminant fallout in precipitation. Information can be used to track changes over time, compare to other western sites for possible exceedance of critical loads, likelihood of harmful ecological effects, and essential information for future work on developing lichen-based critical loads for the region (see Critical Loads under Research and Technology Development).
4. Investigate the EPA designation of non-attainment for particulates (PM_{2.5}) for the Juneau area and determine the best method to understand and monitor possible impacts to the surrounding NF lands.
5. Continue operating the Petersburg IMPROVE Protocol site through FY 2009. Colorado State University and the Alaska Region should review the data and analysis results from the 5-year collection period to determine if a signal exists from trans-Pacific pollution and how the site is contributing information to the national monitoring effort. Work with other IMPROVE station managers and agencies in Alaska for the

development of an Alaska network strategy and establish communication outlets for results.

6. Consider collaboration with FS hydrologists and other federal agencies to evaluate if water chemistry in lakes and streams is being monitored for chemical attributes in relation to air pollution deposition. Consider the USFS Air Program's National Field Monitoring Protocol for western lakes in exploring the possibility of water chemistry monitoring for watersheds in Region 10 for atmospheric deposition impacts (Potyondy et al. in press).

7. Publish the provisional thresholds established for lichens from the Tongass NF in a peer-reviewed journal to compare future biomonitoring efforts and results (Dillman 2007). Compare the Tongass NF thresholds to those in Region 6.

8. Identify areas where additional inventory and monitoring are needed to characterize emissions from non-Forest Service and FS activities, such as on the Chugach in the vicinity of Anchorage and Valdez, and the Skagway and Juneau areas on the Tongass.

9. Consider the use of the Juneau NADP site administered by the FSL, FS (and other agency administered NADP sites in southeast and southcentral Alaska) and determine how this information is useful for monitoring deposition trends for Region 10. At this time, the data do not meet the National Trends Network Completeness Criteria. Collaborate with other agencies in this review and discuss how this information would be useful. Decide whether additional NADP sites would complement overall forest monitoring. Consider establishing a permanent acid deposition monitoring site in each Forest.

10. Establish levels of acceptable change for the lichen thresholds in wilderness, and consider the use of thresholds in lichens for monitoring activities that impact air quality such as mining operations, new power plants on NF lands, or other energy related projects that require diesel generation.

11. Examine the need for mercury monitoring, either in direct precipitation measurement or through bioaccumulation screening of sensitive organisms.

Program Element 2: Coordination with other Agencies, Regions and Outside Groups

Scope:

The efficiency and success of the Region 10 ARM program needs the continued cooperation, coordination and cultivation of working relationships with state and federal regulatory agencies, other federal agencies in Alaska, other Forest Service Regions and the Washington Office, and public and private organizations.

Current Situation:

Working relationships and communication have been established with key personnel within some of the state and federal air regulatory agencies in the region (ADEC, EPA, NPS), and continued communication is necessary. Relationships with research entities such as FIA, PNW and PSW Research Stations, and several universities are established, although more can be developed. Relationships with environmental and public interest groups have not been established. An excellent working relationship has developed over the years with Region 6 in lichen biomonitoring and air pollution modeling. We are currently expanding the relationship with FIA that includes modeling of air quality and climate change impacts with lichen community and elemental data from the Region.

Desired Future State:

Well-established internal and external relationships with research institutions, other agencies and FS Regions, other disciplines and the public to allow the regional and forest-level air programs to efficiently and effectively address the responsibilities as air resource management stewards of Forest Service lands.

Strategies:

1. Identify the key players and learn their responsibilities, expertise, and objectives to help continue and foster relationships between other entities and Region 10 in the future.
2. Involve other agencies in the review of FS documents and reports related to ARM.
3. Maximize coordination and cooperation opportunities within USFS.
4. Identify environmental and public interest groups that may have interest and give input on air quality related issues in the region.

Program Element 3. Education and Awareness

Scope:

This element includes the education of FS employees and external audiences to raise awareness, understanding, and support of the ARM program in Region 10.

Current Situation:

Neither the public, other agencies, nor most Forest Service employees in Region 10 have a clear understanding of the agency's responsibilities for managing the air resource or potential issues.

Desired State:

Plan and implement public awareness and communication programs that disseminate information about air quality in the region.

Strategies:

1. Increase line officer awareness of air quality issues on national forests by conducting briefings when appropriate at meetings of the Regional Leadership Team and Forest Leadership Teams.
2. Increase the general awareness level of FS employees by submitting articles to the Sourdough Notes and other general publications and conducting presentations at appropriate workshops and conferences.
3. Support participation of ARM related staff in other resource related meetings.
4. Seek to increase awareness and understanding of clean air issues in Alaska school children by offering basic ARM concepts and information about lichen biomonitoring to local education programs, possibly as part of the watershed education program (primary, secondary and post-secondary as appropriate).
5. Update the Region 10 ARM briefing paper to include recent changes in the program. (<http://fsweb.stikine.r10.fs.fed.us/tongass/ecology/ecology.shtml>)
6. Support and develop educational materials, training opportunities and publications on lichens as bioindicators of clean air and forest health of the Region.
7. Organize public and within-agency presentations with WACAP NPS scientists and forest personnel to help explain results of the assessment.
8. Bring air related concerns into discussions of climate change impacts on forest resources.

Program Element 4: Research and Technology Development, Transfer, and Needs

Scope:

This element includes developing and transferring new research findings, technologies, and techniques to air resource managers, partners, regulators and interested groups. It also includes communicating research needs to scientists.

Current Situation:

Regions 6 and 10 share information and technology for biomonitoring with lichens. Data are in the USFS air database (see web link above under Accomplishments). Region 6 has started to collaborate in Alaska with the NPS and the Tongass NF to build up the data collected on ambient and precipitation deposition measurements in the vicinity of cruise ships to examine spatial trends in air quality in relation to this industry. Eventually, this information will be used to model deposition and to develop lichen based critical loads for the Region (Fenn *et al* 2008) (see Critical Loads link below). FIA has a network of plots across the Region with lichen community data that will be used for modeling of air pollution and climate change.

Desired State:

Sufficient research is conducted to help describe cause and effect relationships between air pollution source, transport and deposition processes, and ecosystem health. A close working relationship between research and air resource managers exists and adequate funding is available to support needed research.

Strategies:

1. Work to raise the profile of ARM research needs in Region 10 and the Washington Office.
2. Collaborate with the efforts of Regions 6 and 5 in developing sufficient capabilities to characterize air pollution effects in terms of a metric known as “critical load.” Defined as the level of air pollution entering a system below which no unacceptable change will occur, critical load accounts for the direct and indirect influence of air pollution on an integrated resource such as a watershed. Models require certain soil, water, plant nutrient and other data for which protocols are needed (Nilsson & Grennfelt 1988, Porter et al. 2005). http://www.nrs.fs.fed.us/clean_air_water/clean_water/critical_loads/
3. Coordinate with PNW and FIA in the development of an air pollution and climate gradient model for Region 10 using the lichen biomonitoring data from both Forests.
4. Extend the research and modeling conducted by the National Park Service Southeast Alaska Network (NPS SEAN) and the Tongass NF concerning measured deposition in areas where cruise ship emissions are being studied in Skagway, Glacier Bay, Tracy Arm, and Sitka to other areas of the region where concern exists.
5. Attend state and national conferences, technical workshops, and training sessions to maintain and raise internal knowledge of current and emerging ARM issues.
6. Promote ARM research needs such as cause and effect relationships between air pollution and terrestrial and aquatic ecosystems, monitoring techniques and equipment development, for remote areas such as wilderness.
7. Develop partnerships with other agencies to share costs of regional air research and other air programs.
8. Develop regional project proposals for the ARM program that meet the funding criteria for the NFIM budget process and are consistent with the ARM NFIM objectives.

9. Identify integral or scenic views on NFS lands in Region 10 in order to enhance protection of visibility due to air pollution.

Program Element 5. NEPA and Forest Plan Direction and Implementation

Scope:

Activities on federal lands that have the potential to have significant environmental consequences need to be analyzed using the National Environmental Policy Act (NEPA) process. This analysis process considers the consequences of implementing the proposed action on the environment. Additionally, activities conducted on each Forest in Region 10 need to be consistent with the direction for air resources outlined in the respective Forest Plan.

Current Situation:

Presently, few proposed activities analyzed through the NEPA process consider the potential effect of that activity on the air resource. Standards and Guides for air on the Tongass NF include inventory, monitoring, planning and coordination with the state. Standard and Guidelines for air on the Chugach NF include compliance with state standard for visible and particulate air quality. Alaska Department of Environmental Conservation has state standards for PM_{2.5} and PM₁₀ in a 24-hour period.

Desired State:

Use Regional ARM expertise to provide adequate and credible analysis of air quality related issues in appropriate environmental documents. Forest Plan updates include sufficient direction to implement the vision for the ARM program in Region 10.

Strategies:

1. Communicate with forest planners in the development and implementation of monitoring actions that help answer current Forest Plan monitoring questions.
2. As needed, develop guidance for project level NEPA analysis to ensure adequate coverage of issues and effects related to air quality.
3. Utilize opportunities for communication between air quality specialists, wilderness managers and other resource specialists to help achieve common goals and objectives and plan for the development of information needs in relation to air quality in Forest Plans.
4. Consider the use of the contaminant thresholds in lichens for NEPA effects analysis for proposed actions that concern mining and other highly industrial development projects. Utilize the thresholds for monitoring of air quality impacts where applicable.

Program Element 6. Program Administration

Scope:

The ARM program for Region 10 is under the Soil, Water and Air Program Manager. Forests work directly with Regional Office personnel to submit proposals for funding projects and to communicate priorities and issues.

Current Situation:

ARM is not represented by individuals who work exclusively on air quality issues on the Tongass and the Chugach NFs. The air programs at the Forest level are generally administered by the watershed or ecology programs. There are no personnel dedicated

solely to air quality on the Forests or the Region. Prior to development of this plan, the goals of the regional air program have been generally to assess the condition of the air quality of the Tongass NF through biomonitoring, and lesser so on the Chugach NF. This is mainly due to the lack of Class I wilderness in the Region, the lack of understanding of responsibilities related to ARM at all levels, and the lack of major pollution sources near NFS lands that would justify a more intensive and better funded program.

Desired State:

The program elements and plans outlined in this document are understood and supported by all levels of the organization, and the Region 10 program is poised to solicit funds from the WO for priority work in a given fiscal year. Better integration exists between other Budget Lines in relation to air, such as NFIM, to benefit the ARM program and forest health monitoring issues and concerns.

Strategies:

1. The Alaska Regional Forester approves this Region 10 Plan, and it is distributed widely.
2. The Regional ARM program has periodic conference calls and a yearly meeting attended by Forest-level personnel who work in ARM, wilderness managers, hydrologists and other resource specialists with interest in air quality in the Region. Participants develop work plans and collaboratively review Regional priorities and budgets. Meetings may include outside participants who are outside the FS who are interested in Regional air issues.
3. Update this plan in 2013, or when it no longer serves its purpose due to shift in legislation or direction, program emphasis, or substantial workloads and accomplishments.
4. ARM leadership in the Region attends appropriate conferences to stay abreast of developing issues and current research to remain proactive in air resource issues and management.

Program Element 7. Climate Change

Scope:

The USFS recognizes climate is undergoing a period of relatively rapid change in both temperature and in the variability of climate patterns. Impacts are projected to occur in forests, rangelands, and human well-being through ecosystem alteration. Region 10 ARM is a resource area that is flexible and can adapt management strategies to help predict climate change effects and develop new knowledge to manage for future changes while still ensuring goods, services, and values from the National Forests in Alaska.

Current Situation:

Several climate models exist for the coastal area of Alaska (Parson et al 2001). Region 10 ARM has begun collaborating with the NPS, Region 6, PNW and FIA to work on a climate gradient model using the 20-years of lichen biomonitoring data from the Alaska Region. Forest Service activities in Alaska contribute to the process of global climate change through prescribed burns, burning of fossil fuels through all modes of motorized transportation, timber harvesting, and permitting some industrial development on NFS lands such as mining and hydro-power.

Desired State:

A proactive ARM program that is consistent with agency goals for climate change awareness and education. Assist the agency to prepare, plan and adapt to regionally anticipated climate change effects. Participate in mapping and monitoring climate

change effects to forest ecosystems with other research groups. Be leaders in sustainable business operations.

Strategies:

1. Begin to assess ecological impacts of global climate change on AQRV's that the Region has adopted. The Tongass NF uses lichens as AQRV indicators. Lichens are also utilized in wilderness management on the Tongass NF to satisfy the air element in the Chief's Wilderness Challenge. Region 10 will be involved with PNW and FIA in the modeling of lichen data to predict climate change impacts for the Alaska Coastal region.
2. Consider and make more public the data obtained by the FIA concerning ozone monitoring and obtain annual reports of results for resource managers on the Forests.
3. Work with other Regions on effective communication concerning how air quality issues and climate change impacts are interrelated.
4. Maintain past and develop new connections with agencies in understanding the climate and air pollution issues that Alaska faces from international sources. Participate in meetings and workshops in Alaska concerning climate change and air quality.
5. ARM leadership in the Region attends appropriate conferences to stay abreast of developing issues and current research to remain proactive in climate change issues.
6. Reduce CO₂ emissions by reducing and tracking travel and other program elements that contribute to greenhouse gases. Be advocates and set examples for use of public transportation, car pooling, and other low impact transportation where possible.

VII. Action items for FY09 and FY10:

Action Item	Element in Strategy	Personnel and estimated costs
Develop a Region 10 biomonitoring plan for lichens, focusing on wilderness areas near expanding communities and industrial zones, and sites where lichen indicators were above thresholds on the Tongass. Include all the baseline and threshold information and plot locations. Set timelines to re-monitor all permanent plots.	1	Dillman, Charnon 8K
Review and finalize Chugach 1994 report. Compare Chugach baselines to Tongass thresholds for contaminant levels.	1	Dillman, Charnon and statistical consultant 8K
Finalize Chugach lichen vouchers and publish Chugach checklist. Lichens are currently in possession of Chiska Derr, author of Chugach draft air report.	1	Chiska Derr or other consultant 4K
Continue collaboration with NPS and Region 6 in the modeling of diesel emissions near Skagway and Tracy Arm. Establish new permanent biomonitoring plots of NFS near Skagway along the White Pass Railroad corridor and other areas of concern to augment study.	2, 4	Dillman 6K
Finalize briefing paper on interagency work in Skagway.	3	vice Mott and Dillman
Submit Sourdough notes article on interagency air work in Skagway.	2, 3	Dillman, Geiser, vice Mott and Graw
Analyze lichen tissue at U of MN lab. Samples were collected in 2008 near Sitka around the closed pulp mill. Compare results to past levels of contaminants and Tongass thresholds.	1	University of MN 3K
Operate IMPROVE station for 2009	1	Dillman 4K
Establish small purchase order to identify Tongass lichens that remain unidentified	1	Lichenologist contractor 4K
Deploy passive samplers in Tracy Arm for 2009 summer season	1, 2, 4	Tracy Arm wilderness Crew
Communicate and coordinate with FIA and Oregon State University concerning climate model using FIA data and lichens	2, 7	Dillman, Charnon
Develop Alaska coastal lichen poster in partnership with other federal agencies in region, NPS, USFWS	3	Contract artist, Alaska Geographic 4K
Communicate with leadership teams on air quality issues	3	Dillman, vice Mott, Charnon
Contact district watershed education coordinator for possible air quality work for students	3	Dillman, Charnon
Attend state meeting on air quality issues	2, 3, 4	vice Mott, Dillman, Charnon 6K
Plan for USFS National Air meeting 2010 in Juneau	2, 3, 4	vice Mott, Dillman
Communicate and collaborate with FIA, PSW and Region 6 concerning the research and discussion on critical loads in lichens for Alaska and the PNW	2, 3, 4	Dillman

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